W. J. Buckhorn

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
Forest Insect Investigations

Project | Date | Author

TITLE

THE LA GRANDE EXPERIMENTAL SPRUCE BUDWORM CONTROL PROJECT

Season of 1951

(Line Project I-C-6 (3))

By
W. J. Buckhorn, Entomologist
U. S. Bureau of Entomology and Plant Quarantine
and
Dick W. Berry, Research Director
Oregon State Board of Forestry

February 1, 1953

SUBJECT—

INDEX NO.—

U. S. GOVERNMENT PRINTING OFFICE 16—47272-1

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INTRODUCTION

In the years 1948 through 1950 three cooperative experimental projects were undertaken to develop the most effective and economical methods of controlling the spruce budworm (Choristoneura fumiferana Clem.) in the Pacific Northwest. The first of these projects was carried out in 1948 on the Umatilla National Forest near Heppner, Oregon (3) and (4).1/ In this series of tests it was found that a solution of DDT mixed at the rate of one pound of technical grade of DDT in 1.2 quarts of hydrocarbon auxiliary solvent diluted to one gallon with fuel oil applied at the proper time would give upwards of 95% control of the budworm. This experiment provided the information necessary to conduct the extensive and successful control projects carried out against the budworm during 1949 and 1950.

In July 1949 an experiment was undertaken on the Day Ridge area north of Enterprise, Oregon, to determine whether the effective spraying period could be extended and whether a satisfactory substitute for DDT could be found. The spray was applied when the newly hatched larvae were migrating in search of places to hibernate. Oil solutions of DDT, benzene hexachloride and toxaphene were applied. None of these materials proved effective under the conditions of the experiment.

In 1950 test, known as the Chesnimnus Experiment, (1) was carried out in the spring during the normal control period. The objective was to determine the possibility of lowering the cost of control either by reducing the amount of DDT in the spray mixture or by using other toxic ingredients and carriers. The shortage of DDT at the time also indicated a need for finding a substitute material.

Although no satisfactory substitute for DDT was found, tests with reduced dosages of DDT were encouraging to the point that the amount of DDT used in the 1951 control program was reduced from one pound per acre to 3/4 pound per acre and a petrolem solvent, GA-10, was substituted for the combination solvent and fuel oil previously used as a carrier. However, the tests with reduced amounts of DDT, while very encouraging, were not

1/ Refers to list of References on page 8

conclusive. There were indications that still less DDT might give satisfactory results. Furthermore, it was desirable to determine the minimum effective dosage under project conditions. Accordingly the La Grande experiment was planned and carried out in 1951.

OBJECTIVE OF THE LA GRANDE PROJECT

The La Grande experiment was designed to test under the actual conditions of a full scale control project the effectiveness of reduced quantities of DDT in the spray mixture as a means of lowering direct control costs.

DESCRIPTION OF THE AREA

The experiment was carried out on part of an area approved for spraying during the regular 1951 control program. The portion of the area selected for the experiment is located immediately south of La Grande, Oregon, on a long ridge that rises abruptly along the west side of the Grande Ronde Valley then slopes more gradually to the west and north. The elevation ranges from some 2800 feet to approximately 5000 feet. The timber type is predominantly a mixture of young to mature Douglas-fir and true fir. Some ponderosa pine, lodgepole pine and western larch are present in certain locations. Going into the winter of 1950-51 the budworm infestation ranged from light to heavy, but over most of the area was moderate in character. Numerous roads gave ready access to all portions of the area after they were cleared of fallen trees. In these respects the La Grande area appeared well suited to the experiment.

COOPERATIVE AGREEMENT AND PERSONNEL

This experimental project was a cooperative undertaking by the Bureau of Entomology and Plant Quarantine, Oregon State Board of Forestry and the U. S. Forest Service. The Bureau provided technical guidance and supervision in the biological phases of the project and the Oregon State Board of Forestry administered the project. The cost was shared by the Oregon State Forestry Department and the U. S. Forest Service. The area was flown under contract agreement between the State of Oregon and Ace Flying Service of Salem, Oregon.

The following men at various times were engaged on the project:

U. S. Bureau of Entomology and Plant Quarantine

W. J. Buckhorn, Technical Supervisor
James Matthias - Plot lay-out and checking
P. W. Orr - " " "
R. P. Harrison - " " "
W. F. Truax - " " "

Oregon State Board of Forestry

Dick Berry, Research Director
Harold Dixon, Project Supervisor
Bob Stevens, Plot lay-out and checking
Don Haskins, Plot lay-out and checking
Al Lindsten, Mortality checking
E. F. Coulter, Inspection pilot
Ace Flying Service
Pilots - Burrus
Kemp
Zak

The cooperation of Miles Compton and Frank Blizzard of the Northeast Oregon Forest Patrol was very helpful in the conduct of the project.

GENERAL PLAN

The plan was to apply reduced mixtures of DDT under conditions actually encountered on a control project. To accomplish this, the test was carried on as an integral part of the 26,204 acre La Grande control project. Except for the amount of DDT in the solution, all phases of spray application on both the experiment and other portions of the project were identical.

The insecticides were all applied at the rate of one gallon per acre. The 3/4, 1/2 and 1/4 pound treatments were formulated in an identical manner -- sufficient GA-10 solvent was added to each lot of technical grade DDT to provide the desired ratio of 3/4, 1/2 and 1/4 pound per gallon of resultant solution.

Each mixture was applied on two blocks of 2000 acres each. For each dosage, one 2000 acre block was to remain unsprayed as a check. It later became necessary to reduce the number of check plots to a total of two.

The attached map shows the experimental area and the location of the plots and the sample lines. The following table indicates spray applications by spray blocks:

Block No.	Formulation	Acreage
2	3/4 pound	2000
5	3/4 "	2000
1	1/2 "	2000
1-B	1/2 "	2000
1-A	1/4 "	2000
3	1/4 "	2000
7	No Spray (Check Plot)	2000
1-C	No Spray "	2000
Total 8		16,000

OPERATIONAL PROCEDURE

Field work on the project was initiated on May 24 and continued until July 18 when the post-spray checking was completed.

Good aerial mosaics of the area on a scale of approximately $3\frac{1}{4}$ inches per mile were provided by the Oregon State Board of Forestry. These proved invaluable, especially in laying out check lines.

Plot Location

The experimental spray blocks were laid out as part of the regular procedure in blocking out spray compartments on the La Grande control project. There were nine blocks of approximately 2000 acres each, located on the north half of the control project.

Marking of Blocks

Most of the block boundaries were well defined by natural features such as openings, ridge tops, streams and roads. In a few places where natural features were lacking, boundaries were marked by 3 x 5 feet flags of orange-colored cloth placed in the tops of the highest snags or trees

either by climbing or by shooting a line over the top with a line throwing gun and hoisting the flag into place. At two locations ground markers were utilized. These were placed in large openings and consisted of rocks arranged in two 16-foot rows forming a right angle. The rocks were then painted with aluminum paint.

Pre-spray Check

To facilitate checking the results, sample check lines were run out by compass and pacing at right angles to the anticipated direction of flight. Two lines each 90 chains in length were established on each unit. The lines were marked with paint so they could be easily followed on subsequent trips. Along each line, check points were established at 10-chain intervals. For sampling purposes five trees were marked at these locations with shipping tags.

The first population checks were carried out one or two days prior to spraying. This check consisted of clipping two 15-inch branches from each tagged tree and counting and recording the number of larvae present. The branches were taken from as near mid crown as possible by using 12-foot pole pruners equipped with a basket to catch the branches and any budworms which might be dislodged.

Location of Airfield

Aircraft used on the project were based at the La Grande Municipal Airport which is located approximately 6 miles southeast of La Grande. Storage and loading facilities for the La Grande project and several other control projects were installed at the field. Air line distances from the field to the experimental area ranged from $3\frac{1}{2}$ to approximately 10 miles.

Spraying Operations

Stearman-type biplanes equipped with 450 horsepower engines and external spray booms were used to apply the spray. They were typical of the small planes used generally on the control projects.

Spraying began on June 21 and was completed on June 30. Measurements of wind velocity, temperature and relative humidity which are limiting factors in spray application were taken at Glass Hill lookout near the south boundary of the experimental area. Spraying was discontinued when the wind attained a velocity of 6 miles per hour or the temperature reached 68 degrees F. No spraying was done on wet foliage.

On June 21 when spraying began budworm larvae at low elevations had developed into the following instars 4th-36%, 5th-60%, 6th-4%. As the spraying progressed from low to high elevations, larval development also progressed. As a result the larval stages were quite similar on all blocks when they were sprayed.

On control projects pilot error such as extending the spray swath a short distance into an adjacent block or a flight off course are common. Such errors are of little consequence and are easily corrected. Unfortunately similar errors also occurred on the experimental project and caused considerable disruption of plans. One spray block was ruined by several random off-course spray swaths. Check lines had to be moved twice on one block and once on another due to inadvertant extension of spray swaths. One of the check areas was substituted for the spray block that had to be eleminated from the experiment. The check block could not be replaced due to lack of additional infestation in this portion of the region. As a result, there were only two unsprayed check blocks instead of the three originally planned.

Spray Distribution Check

In order to check the spray distribution one 4" x 4" glass plate was placed at each check point one day in advance of spraying. Immediately after the spray was applied, these plates were examined for the required number of spray droplets of which a minimum of 20 was considered adequate. The spray deposit on all plates was found to have been satisfactory.

Post Spray Check

The final check was made 12 to 18 days after spraying to allow maximum effects of the spraying to develop. This check consisted of clipping two 15-inch twigs from each of the five tagged trees originally sampled at each check point. All living larvae or pupae present on the sample twigs were counted and the record completed for each tree.

RESULTS

The results of the experiment are tabulated in the accompanying table. In summary they are as follows:

<u>3/4 pound of DDT</u>: The budworm mortality from this treatment averaged 97.3 percent. Kill was fairly uniform. On 17 of the 40 check points 100 percent mortality was recorded. 78.5% was the least kill recorded at any check point.

1/2 pound of DDT: Mortality from this treatment averaged 94.5 percent. The kill was somewhat erratic ranging from 45% to 100 percent at the various check points. 100 percent kill was recorded at only 8 of the 40 check points.

1/4 pound of DDT: This treatment resulted in an average mortality of 87.3 percent. At 9 check points, 100% kill was recorded. On the other 31 points the mortality was very erratic and ranged down to 39%.

Check Blocks: Budworm mortality from natural causes averaged 45.8 percent for the two check blocks. The highest mortality found at any check point amounted to 76%. This normal mortality is somewhat less than the 60% found to have occurred on portions of the La Grande area in 1950 by Mr. V. Carolin (2).1/

DISCUSSION AND CONCLUSIONS

The spray was applied under normal project conditions of weather and larval development. Although on several occasions abnormal wind conditions occurred in localized areas. Spray coverage on all blocks was excellent. The results obtained approach the maximum that can be expected under project conditions from each of the solutions tested.

The 97.3 percent control obtained with the 3/4 pound DDT solution can be considered good but not excellent. Survival of larvae at 23 of the 40 check points indicate that little if any margin of safety remains to allow for adverse conditions or any increase in height of flight that pilot safety might require. Any decrease in the 97.3 percent control achieved would soon offset any savings in costs effected by the reduction in the amount of DDT used.

Mortality resulting from the application of the 1/2-pound DDT solution average 94.5 percent which is in the range of control considered to be satisfactory. Ninety percent kill is considered to be the minimum. If applied under conditions less ideal, it is doubtful if the 1/2 pound solution would result in satisfactory control.

The 1/4-pound DDT solution gave 87.3 percent control which is less than the 90 percent kill considered to be acceptable on control projects. The acceptance standards of budworm mortality set up for control projects is as follows:

98-100% Excellent; the project average should fall in this range.
95-98% Good; acceptable on blocks and occasional units.
90-95% Marginal; acceptable on occasional blocks but not units.
Less than 90% Unsatisfactory.

At present there are no immediate prospects of materially lowering the costs of control by reduction of the DDT in the spray solution. There is however the possibility that some cheaper spray material may be developed; but before going into further large-scale experiments, it is advisable to undertake a series of small-scale toxicity tests.

1/ Refers to list of References on page 8

REFERENCES

(1) Brockman, C. Frank & Berry, D. - The Chesnimnus Experimental Spruce Budworm Control Project. December 31, 1950. Oregon State Board of Forestry, Research Bulletin No. 5.

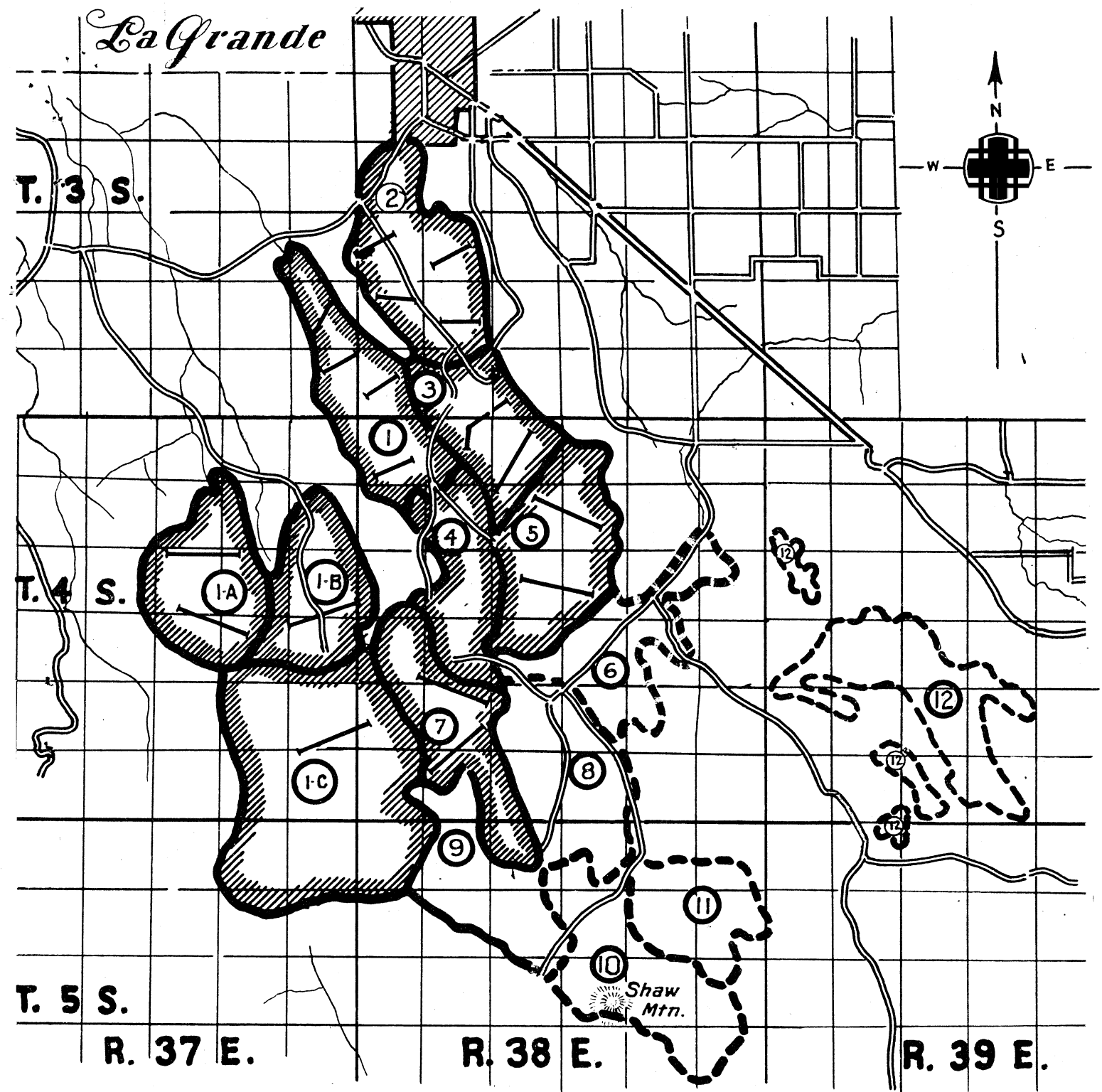
(2) Carolin, V. M., Jr. Special Office Report. Studies of the Biological Control of the Spruce Budworm in Oregon 1950.

(3) Eaton, C. B., Beal, J. A., Furniss, R. L., and Speers, C.F., Airplane and Helicopter Spraying with DDT for Spruce Budworm Control. Journal Forestry Vol. 47, No. 10, pp.823-827, Oct. 1949.

(4) Rogers, N. S. The Spruce Budworm Experimental Control Project. pp. 69-73, Biennial Report of the State Forester to the Governor (of Oregon). July 1, 1946 to June 30, 1948.

SUMMARY OF CHECK LINES ON LA GRANDE EXPERIMENTAL SPRAY PROJECT

Block No.	Treatment	Check Line No.	Pre Spray Check Date	Pre Spray Check Larvae	Spray Date	Post Spray Check Date	Post Spray Check Larvae	Elapsed Time Spray to Post Check	Percent Mortality
1-A	¼ lb. DDT	2	6-28	652	6-29	7-12	147	14	77.4
		3	6-28	854	6-30	7-13	72	15	91.6
	Sub Total			1506			219		85.4
3	¼ lb. DDT	1	6-26	721	6-29	7-16	82	18	88.6
		2	6-27	703	6-30	7-16	70	17	90.0
	Sub Total			1424			152		89.3
Treatment Total				2930			371		87.3
1	½ lb. DDT	1	6-25	829	6-26	7-11	42	16	94.9
		2	6-25	743	to	7-10	91	15	87.8
	Sub Total			1572	6-28		133		91.5
1 B	½ lb. DDT	1	6-24	626	6-25	7-12	16	18	97.4
		2	6-24	820	to	7-12	21	18	97.4
	Sub Total			1446	6-28		37		97.4
Treatment Total				3018			170		94.4
2	3/4 lb. DDT	1	6-22	672	6-22	7-9	46	17	93.2
		2	6-22	862	6-23	7-9	25	17	97.1
	Sub Total			1534			71		95.4
5	3/4 lb. DDT	1	6-18	1456	6-21	7-7	21	20	98.6
		2	6-18	737	6-22	7-7	11	20	98.5
	Sub Total			2193			32		98.5
Treatment Total				3727			103		97.2
7	Check Area	1	6-25	922	No	7-10	460	15	50.1
		2	6-26	719	Spray	7-11	433	15	39.7
	Sub Total			1641			893		45.5
1-C	Check Area	4	6-29	549	No	7-11	385	12	29.9
		5	6-30	529	Spray	7-17	176	17	66.8
	Sub Total			1078			561		48.0
Check Total				2719			1454		46.3



LA GRANDE EXPERIMENTAL BUDWORM CONTROL PROJECT

Boundaries of Experimental Spray Blocks

Boundaries of Control Project Spray Blocks

(6) Spray Block Numbers

Approximate Location of Check Lines

Scale 1/2" = 1 Mile

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